The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Quis Custodiet ?

THE Prime Minister, in the Lord Mayor's Day speech which Sir John Simon read for him at the Mansion House in London, felt it necessary to refer to current complaints about war restrictions and controls imposed by the Government. He pleaded not for a total abstention from criticism, but for reasonable tolerance of inevitable errors and more generous recognition of good work. He also asked that responsibility should be placed upon Ministers responsible for policy and not upon the Civil Servants who had only to carry it out.

Nobody will dispute the propriety of this broad definition of the constitutional position any more than he would quarrel with any aspect of the Prime Minister's leadership in these critical times. Mr. Chamberlain has been magnificent and no man has ever more completely earned the gratitude of the nation. While, however, his approach to the question of Government controls is characteristically sound, there are detailed aspects of the position in which manufacturers and traders find themselves that need to be emphasised afresh. From the first day of the conflict this journal has contended that whatever the war aims of the British people may be, the clamping down upon it of a bureaucratic machine is certainly not one of them.

What was said in these columns in the first few days of the war about hasty, ill-considered and excessive controls is now common throughout the Press. Some of the major absurdities have indeed been rectified. The Fish Control went out of business after less than a week. Fuel rationing has been so far modified as to render it, for the time being, an expensive superfluity. The threat that the housewife would have in future no choice between different brands of tea and margarine has gone the way of the one and only daily newspaper with which the inventors of the Ministry of Information were at one time toying. These withdrawals of the heavy hand of the bureaucracy, with the exception of the last, would probably not have been secured without the pressure of public opinion. If inevitable is the right adjective to apply to the controllers' errors it is, by the same token, the only possible word to use about newspaper and parliamentary criticism in a democratic country.

It is something to the good that there has been some loosening of control. Every business man who can raise his head for a moment above the flood of official forms and returns knows that the process has not gone nearly far enough. He is by no means lacking in respect for the qualities and abilities of pre-war Civil Servants. He regards them as indispensable for diplomatic, police and sanitary services in a civilised community. At the same time he gravely doubts their utility in the fields of trade and commerce. He is specially appalled by the stream of new officials who have been appointed since September 3. Where these men have been dressed with a little brief authority over existing businesses there is an obvious risk of their being redundant, overlapping better men and positively restricting rather than expanding business.

There will probably be general agreement that the lifelong Civil Servant is totally unfitted by his training and experience for the taking of quick decisions and the facing of serious risks on which modern business depends. The argument may then be raised that this difficulty has been met by the appointment of trade experts as quasi Civil Servants for the duration of the war. The trouble with the trade expert who suddenly acquires the status of a Civil Servant is that he seems fated to be inoculated with an unusually violent dose of the bureaucratic bug. Most business men can give examples of former business colleagues turned controllers who are proving more royalist than the King. No professional Civil Servant was ever so officious as some of our new officials.

In any event, the entire conception of the war control of business needs thinking out afresh. Control in any form can only be regarded as a nuisance, although, admittedly, considerations such as a serious deficiency of supplies may make it temporarily necessary. Still, the aim of the Government all the time should be to limit rather than to increase control. Businesses can be controlled to such a point that nothing at all is left of them. Uncontrolled they have the best possible chance of making their indispensable contribution to the war effort.

An English Trait

In a recent letter published in *The Times* Mr. Hubert Payton quotes the following extract from Lord Cromer's "Modern Egypt": "Mistrust of Government officials is engrained in the English character, and I may add that I hope the dislike of being over-governed will ever continue to exist in England."

NOTES AND COMMENTS

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Canadian Trade

CANADA'S total domestic exports in 1938 declined 17.7 per cent. in value compared with the previous year, and there was a decline of 16.3 per cent. in imports, according to the *Report on Economic and Commercial Conditions in Canada*, published by the Department of Overseas Trade (H.M. Stationery Office, 2s. 6d.). Exports to the United Kingdom declined 16 per cent. and, as might be expected, 1936 was not as satisfactory a year for the Dominion as was 1937. The export of non-ferrous metals and their products in 1938 were valued at 255½ million dollars, which represents an increase of from 7 per cent. to 30 per cent. Canada had a favourable export balance in 1938 of 236 million dollars, 220 million dollars of which were derived from the United Kingdom. With Europe, other than the United Kingdom, she had a favourable balance of about 38 million dollars.

Growth of Chemical Industry

TOTAL imports of chemicals and allied products declined from 36.9 million dollars in the year ending March, 1938, to 34.9 million dollars in the following year. Imports from the United Kingdom totalled 7.7 million dollars in 1937-38, and nearly 7 million dollars in 1938-9. In the same year imports from the U.S.A. declined from 22.7 million dollars to 21.8 million dollars. Germany was the next most important supplier in this group and imports from that source declined from 2.8 million dollars to less than 2.3 million dollars. The report adds that the Canadian chemical industry has grown rapidly and year by year is supplying a larger percentage of the requirements of the domestic market. Preliminary statistics for 1938 place the value of chemicals and allied products manufactures in Canada at 145 million dollars, 2.6 per cent. less than the record total of 1937.

United States Mercury Production

DOMESTIC production of mercury in the U.S.A. during the month of September was approximately 1,500 flasks, according to the Bureau of Mines, U.S. Department of the Interior. This total is based on reports received from 30 mines that accounted for 95 per cent. of the total output in 1938. The rate of producton during September was almost identical with the monthly average of 1,499 flasks for 1938. Producing companies held small stocks of metal at the end of September, those who reported on production indicating an inventory of only 318 flasks. The rate of production during September was not influenced to any extent by the sharp rise in the price of mercury following the outbreak of the war. However, according to reports submitted by producers, increased activity is evident at many properties that have produced in the past, and some of these properties have already resumed production. Plans are also being pushed to increase recovery of metal at mines that have been in regular operation.

Chemical Research

SINCE its formation a little over three weeks ago the Advisory Research Council set up by the Council of the Chemical Society under the chairmanship of Sir Robert Robinson has met on three occasions. It will be remembered that the Council was formed for the main purpose of bringing to the notice of Fellows and others engaged in chemical research subjects for investigation likely to be of potential value to the nation at the present time. The field to be covered embraced every branch of pure chemistry, including bio-chemistry and metallurgy, and chemists and various organisations were invited to send in suggestions for research. Since the scheme was launched the Council has received a considerable number of topics for research as well as information from supervisors of research concerning particulars of their facilities and qualifications of their staffs. At the last meeting held a week ago, the Council allocated various problems for investigation to laboratories and other research organisations and individuals. In order that the Advisory Council may be cognisant of pressing problems needing investigation and thus be able to suggest lines of research of national value, liaison has been effected with Government departments and industrial organisations.

Oilcake Brokers' Committee

A GROUP of the principal cattle food trade associations in England have authorised the formation of a special Oilcake Brokers' Section for the purpose of pooling and distributing the remuneration derived from the sale of imported oilcakes and meals within the scope of the Government Feeding Stuffs Control. Each Association's brokers' section will appoint two of its members to constitute a national joint committee to administer the entire business of the pool. The basis of the distribution from the pool will be computed by reference to the average annual gross profits for the last four consecutive accounting periods before July 31 last, such profits having been earned in respect of sales to buyers in the U.K. of imported oilcakes and meals (but excluding compound cakes and meals, cereals and cereal products, fish, meat and bone meals, and Burma, Siam and Saigon rice bran), but including tapioca products and locust beans. It is the intention of the Control to continue the use of established brokers, but with only one buyer in the market the services of only a very few brokers can be utilised. Every transaction will carry a commission, which will be paid into the pool for subsequent distribution among all members.

NEW CATALYTIC SYNTHESIS OF HYDROCARBONS*—I

Alkylation Controlled by Paraffins

By
PROFESSOR V. N. IPATIEFF

DURING the last few years two catalytic methods for the synthesis of aliphatic hydrocarbons have been tried. The first consists of the polymerisation of olefines, together with production of higher homologues which can be very easily hydrogenated to make paraffins, if required. The second permits the alkylation of paraffins with olefines. This reaction was long held to be impracticable owing to the inactivity of saturated aliphatic hydrocarbons.

The development of catalytic polymerisation of olefines to the stage of commercial utilisation is one of the most important achievements of petroleum experts. There are now numerous polymerisation plants working in large or small refineries, and producing a polymerisation oil of high value. The story of this development is interesting, but as many papers have already been written on the subject, I will deal with this question only as an approach to the little known subject of alkylation. It seems that alkylation must be the great step forward in the synthesis of hydrocarbons to produce a greater quantity and better quality of motor spirit.

Higher Homologues of Paraffins

Although the alkylation of aromatic hydrocarbons has been much studied for a long time, it is only six years since we first discovered that paraffins can equally well react with olefines to produce alkylation products, *i.e.*, higher homologues of the paraffins. The reaction is catalysed by metallic haloids. It should be noted that alkylation of paraffins has an advantage over alkylations of the Friedel-Crafts type, since the alkylation agent is not an alkyl haloid but an olefine. Alkylation controlled by paraffins is clearly an excellent method for the synthesis of different paraffinic hydrocarbons. It has a marked advantage over the polymerisation-hydrogenation method, for the same result is obtained in a single phase by eliminating the hydrogenation process:

$$C_nH_{2n+2} + C_mH_{2m} \rightarrow C_{n+m}H_{2(m+n+1)}$$

The probable mechanism of the reaction may include the reaction of the paraffin with a complex olefine chloroaluminate. Thus:

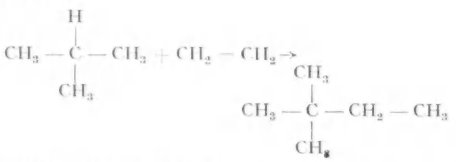
$$AlCl_3 + C_2H_4 \rightarrow ClCH_2CH_2AlCl_2$$
$$(CH_3)_3CH + ClCH_2CH_2AlCl_2 \rightarrow (CH_3)_3CCH_2CH_2AlCl_2 + HCl$$
$$(CH_3)_3CCH_2CH_2AlCl_2 + HCl \rightarrow (CH_3)_3CCH_2CH_2 + AlCl_3$$

The alkylation of isobutane with ethylene may be taken as an example. Grosse and I have studied this reaction minutely, using boron fluoride as a catalyst. With a varying temperature, under pressure of ethylene and in presence of aluminium chloride, Pines, Komarewsky, Grosse and I obtained the following products (practically the same results were obtained when boron fluoride was used as a catalyst):

Nature of Product.	Percentage by Vol.
Isopentane	16.0
Hexanes	41.0
Heptanes	9.4
Octanes	12.3
Nonanes	6.5
Higher paraffinic homologues	14.8

Hexanes are naturally the principal products of the reaction.

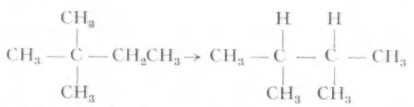
The isomer, the formation of which would be anticipated in the largest proportion, is 2 : 2-dimethyl-butane. Its formation reaction is:



Another isomer, 2-methyl-pentane, which is formed by condensation with one of the primary atoms of paraffin carbon, is present in a much lower proportion. But it has been discovered that none of these products predominate. Roughly, 80 per cent. of the hexane fraction was 2 : 3-dimethyl-butane, 18 per cent. was 2-methyl-butane, and 2 per cent. only was the 2 . 2 dimethyl-butane.

The basic principle of the analysis of the hexanes is interesting. The bromination of 2 : 3-dimethyl-butane, under the influence of sunlight, produces a crystalline dibromide, viz., 2 : 3-dibromo-2 : 3-dimethyl-butane, whilst under identical conditions, the 2-methyl-pentane gives only liquid products and 2 : 2-dimethyl-butane does not react at all.

It is evident that 2 : 3-dimethyl-butane cannot be the principal product of the reaction. The mechanism of its formation is probably also obvious. 2 : 2-dimethyl-butane, which is a principal product, is isomerised by a catalyst producing 2 : 3-dimethyl-butane.



It has been shown that identical isomerisations are produced in presence of aluminium chloride.

Self-Destructive Alkylation

The formation of isopentane was undoubtedly due to another secondary reaction, that of self-destructive alkylation. This reaction, which is the basis of cracking petrol in presence of aluminium chloride, was the subject of research in 1936 by my collaborators and myself. The action of aluminium chloride leads to the rupture of the paraffin chain with formation of a lower homologue of paraffin and an olefine in the nascent state. The olefine can then either alkylise the original paraffin by producing a paraffin of a higher series, or react with aluminium chloride to produce complex additive compounds which form what is known as the "lower bed":

$$C_{k+1}H_{2(k+1+1)} \rightarrow C_kH_{2k} + {}_2C_1H_2$$
$$C_{k+1}H_{2(k+1+1)} + C_1H_2 \rightarrow C_{k+2}H_{2(k+2+1)}$$

Applying the reaction to octane, obtained by the reaction of isobutane with ethylene:

$$C_8H_{18} \rightarrow C_5H_{12} + [C_3H_6]$$
$$C_8H_{18} + C_3H_6 \rightarrow [C_{11}H_{24}], \text{ and the net effect is:}$$
$$2C_8H_{18} \rightarrow C_5H_{12} + C_{11}H_{24}$$

By alkylation of isobutane with ethylene, it is possible to obtain a by-product, isopentane; this reaction is as follows:

$$C_4H_{10} + [C_2H_6] \rightarrow C_7H_{16} \text{ and } C_7H_{16} \rightarrow C_5H_{12} + [C_2H_4]$$
$$[C_2H_4] + C_4H_{10} \rightarrow C_6H_{14}, \text{ and the net effect is:}$$
$$2C_4H_{10} + [C_2H_6] \rightarrow C_5H_{12} + C_6H_{14}$$

In the same way, isobutane has been successfully alkylated

* Translated from *Chimie et Industrie*, Vol. 42, p. 215.

with propylene and butylenes. The reaction with the *n*-butylene is important, since a yield of 65 per cent. of octanes; and especially 2 : 2 : 3-trimethyl-pentane is obtained. Other paraffins such as *n*-butane, pentanes and hexanes have also been alkylated with various olefines. Under the right conditions, it is possible to obtain more or less satisfactory yields of the required paraffins.

Alkylation of propane has not yet been achieved. As I shall show later on, that is probably owing to the absence of a tertiary carbon atom, as well as the impossibility of isomerising it into an isomer containing such a carbon atom.

Naphthenes like cyclohexane and others are alkylated in the same way by olefines in presence of haloid metallic salts, and produce naphthene substitutes. The mechanism of this operation is analogous to that for the alkylation of paraffins. When cyclohexane reacts with ethylene in the presence of aluminium chloride and gaseous hydrogen chloride, the reaction product is not ethyl-cyclohexane, but its isomer, 1 : 3-dimethyl-cyclohexane. Hydrogen chloride gas is a necessary promoter of alkylation; when it is absent, only products of polymerisation are obtained. From the lower layers of the catalyst an interesting by-product from the alkylation of cyclohexane with ethylene can be obtained: hexaethyl-benzene. Its presence seems to indicate intermediary formation of hexaethyl-cyclohexane.

Intramolecular Hydrogenation

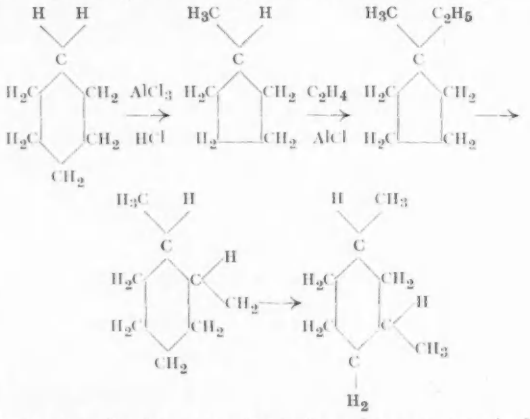
Intramolecular hydrogenation is actively produced in the presence of aluminium chloride; hydrogen from cyclohexane is clearly absorbed by ethylene from the time when a fair amount of ethane can be found in the gases given off. It is more probable that non-alkylated cyclohexane is present rather than hexaethyl-cyclohexane, which is dehydrogenated. It is unlikely that hexaethyl-cyclohexane will be formed, since the ethyl group is very easily isomerised into two methyl groups. The fact that the aromatic compound only is found in the lower layers is due to the formation of additive aromatic compounds with the halogen salts of aluminium. In this way we have prepared a crystalline compound with the formula $C_6(C_2H_5)_6$, $2AlBr_3$. Other naphthenes which have been alkylated with ethylene in the presence of aluminium chloride and hydrogen chloride gas comprise the following: methyl-cyclopentane, methyl-cyclohexane and methyl-isopropyl-cyclohexane. The reaction proceeds quite normally at room temperature and under normal pressure.

Although boron fluoride acts as a catalyst in the alkylation of methyl-cyclopentane and methyl-cyclohexane with ethylene, it does not catalyse the ethylation of cyclohexane. Its action is not as progressive as that of aluminium chloride; it produces with the formation of alkyl-naphthenes a certain polymerisation of ethylene and probably rupture of the naphthenic ring leading to paraffins. The fact that cyclohexane, in the presence of boron fluoride, cannot be alkylated is important, since it explains the mechanism of alkylation of naphthenes and paraffins. It should be noted that in every example of alkylation of these two types of hydrocarbons, the compounds either possess a tertiary carbon atom or can easily be isomerised by the addition of an isomer containing such an atom.

When aluminium chloride is present, the *n*-butane is isomerised into isobutane; cyclohexane into methyl-cyclopentane. On the other hand boron fluoride does not catalyse the isomerisation of cyclohexane under the conditions of alkylation. It does not form a tertiary carbon atom, nor is this produced from alkylation. Methyl-cyclopentane and methyl-cyclohexane have tertiary carbon atoms and are easily alkylated in the presence of boron fluoride.

The hypothesis that a tertiary carbon atom is necessary for alkylation is confirmed by the fact that cyclopentane cannot be alkylated with ethylene, even when aluminium chloride is present.

The reason for the special behaviour of compounds with a tertiary carbon atom is obvious. It is known that the hydrogen atom bound to a tentiary carbon atom is very weak. Now, condensation of a whole hydrocarbon with an olefine needs a weakly bound hydrogen atom, irrespective of whether the reaction occurs by the means already described or in some other way; the net result of the reaction is the addition of hydrogen and an alkyl group to an olefine. It seems then, that, contrary to expectation, alkylation of cyclohexane with ethylene in the presence of aluminium chloride does not take place with an intermediary formation of ethyl-cyclohexane which is then isomerised into dimethyl-cyclohexane, as was first shown by Grignard and Stratford and which we have verified. The reaction perhaps allows preliminary isomerisation of cyclohexane into methyl-cyclopentane, and the alkylation of the latter, conforming to the following, each stage of the change being observed by the use of a pure compound:



Benzene and other aromatic hydrocarbons possess hydrogen atoms which can fairly easily be weakened. It is to be expected that they can easily be alkylated by olefines.

Alkylation is produced in the presence of haloid salts or acids. Since the same substances also catalyse polymerisation of olefines, it is clear that the alykylation reaction is produced only if it takes place more swiftly than the polymerisation reaction. If conditions (temperature, pressure, and concentration of catalyst) are well chosen, the speed of the reaction desired at the expense of the secondary reaction may be appreciably increased. The use of aluminium chloride as a catalyst for alkylating benzene is too well known to need mention here, but amongst other haloid metallic salts acting as catalysts are boron fluoride, zirconium chloride, and tantalum chloride.

Mono- and Poly-Alkylated Benzenes

The mechanism of the reaction is probably the same as for the alkylation of paraffins. The reaction production is made up of a mixture of mono- and poly-alkylated benzenes, which can easily be separated by fractionation. Alkylation in the presence of sulphuric acid at a temperature of 0 deg. C. to 25 deg. C. gave some interesting and instructive results. Three concurrent reactions can be produced in a mixture of benzene, sulphuric acid and an olefine: (1) fixation of the olefine on benzene; (2) polymerisation of the olefine; (3) fixture of the olefine with acid, with formation of an ester.

The effect produced by the variations of the concentration of sulphuric acid when other conditions, such as temperature, pressure, quantity of benzene and olefine, remain constant has been studied. It was ascertained that dilute acid led primarily to the production of esters; concentrated acid catalysed alkylation, whilst intermediate concentrations led to a mixture of ester and either polymers or alkylbenzene. It is thus that the predominant reaction of propylene in the presence of benzene and sulphuric acid of 96 per cent. strength is alkylation, whilst with 80 per cent. acid propylene reacts almost equally in two directions: ester-formation and alkylation. The three reactions are especially noticeable with isobutylene.

(*To be continued.*)

Hot Spraying of Shellac

A New Method of Coating Surfaces

MATERIALS used in protective coatings are generally used in solution or emulsion forms applied by brush, spray or pad. Attempts have been made in recent years to develop and improve the technique of application by spraying solutions or dispersions of materials at temperatures higher than the ordinary, thereby reducing the cost of solvents and increasing the fluidity of viscous or solid materials. There are a number of inherent drawbacks in using any solvent at all. Not only are the solvents largely wasted by evaporation, but the film-forming molecules also become oriented in relation to the surface; a small amount of solvent is also invariably retained by the film even after prolonged drying. This residual solvent and the characteristic orientation of the polar groups present in the film are responsible for the poor water resistance, and generally speaking, the comparatively short life of the protective coat. Some recent work of the London Shellac Research Bureau carried out by Mr. K. S. Lalkaka under the supervision of Mr. J. P. Mullen and Professor H P. Watson, has shown a simple technique for spraying shellac in the absence of solvents or diluents.

The high viscosity of whole shellac when liquefied, and the difficulty of maintaining it fluid for any considerable length of time, were responsible for the failure of the original experiments to melt and spray it under steam pressure. Later efforts were directed towards using pulverised shellac and causing the powder to fuse by passage through a flame, the fused particles being projected upon a surface to form a well-bonded coat. Preliminary experiments using a spray of powdered lac through a gas flame proved promising, and further work consisted mainly of the designing of suitable equipment and the analysis of the data of the various processes.

The comparatively low density of lac (1.15 to 1.2) suggested a gravity-suction feed arrangement in order to secure a steady supply of the powder through the flame, and no irregular spurts in the stream of particles being delivered from the end of the powder container. Powder above 60 mesh was found to be too coarse, and below 150 mesh it ceased to be free-flowing, and simple apparatus was designed, employing a compressed-air nozzle maintaining a velocity of not less than 50 ft. per second (100 ft. per second produced the best results), and a blowpipe flame about 4 to 5 in. long of ordinary town gas. The particles of shellac were projected through this flame on to the surface to be coated. The 100 to 150 mesh powder provided a coat with a minimum thickness of 0.085 mm. and having a more even surface than the 60-80 grade. An average loss in combustion of 13 per cent. shellac was noted.

Satisfactory Treatment of Surfaces

Surfaces that have been satisfactorily treated by the process include wood, paper, tin, aluminium and copper sheet, concrete, glass, asbestos board, plaster castings, and porous stoneware. At present, coatings of shellac on paper are largely produced for electrical purposes by spraying a solution of shellac in spirit and using elaborate drying ovens to drive off the solvent, thus leaving a coat of shellac which tends to be rather patchy and blistered, due to the rapid evaporation of the solvent Further, the chemical and electrical properties of shellac after solution in alcohol are not quite so good as those of whole shellac. Hence, a considerable field exists for the use of the method now described.

Shellac, if taken internally in small quantities, is inert and harmless; hence, concrete and cement-covered masonry tanks for the storage of oils and fats could, with advantage and safety, be given a sealing and protective coat of shellac by this method. In the case of rough or porous surfaces, the large amount of loss through absorption into the surface which occurs if a paint or solution is used would be eliminated. In the large mild steel tanks used for the storage and transport of crude oil, much corrosion is caused by traces of the free acid present. Since shellac is inert both to mineral oils and to aqueous acid solutions, it could be used for such purposes.

Some tests were carried out, using powder containing 50 per cent. by weight of a copper or arsenic compound of shellac. It was found possible to spray the mixture through the present apparatus. This may have possibilities as an anti-fouling coating for the under-water portions of ships, yachts and metal floats. The treated part would be almost immediately ready for use.

Defelting Wool

Treatment with Sulphuryl Chloride

A NEW method for the defelting of wool, not involving the use of free chlorine, is described by Hall (Jour. Soc. Dyers and Colorists, 1939, *55*, 8, 389-401). The universally employed method of defelting wool by treatment either with free chlorine, or with substances such as bleaching powder which generate it, has the great disadvantage of promoting oxidation of the wool and therewith reducing its strength. The process in fact removes all the epithelial scales, which reduces the tendency of the fibres to interlock which causes felting, but at the same time also reduces their strength. It has been found that sulphuryl chloride, applied to the wool in the form of a solution in a high boiling white spirit, removes the felting properties of the wool, without causing the damage to the fibre that chlorine does. The SO_2Cl_2 can be satisfactorily removed afterwards by extraction with water.

In preliminary experiments on the new process, it was established that the most satisfactory procedure was to apply the sulphuryl chloride as a 2.5 per cent. solution, in a white spirit with a boiling range of 165-260° C. The wool should be conditioned in air of 60 per cent or higher relative humidity, and the treatment must be continued for 1-2 hours, the optimum temperature being 20° C. Under these conditions, the felting, as measured by the percentage shrinkage on treatment with water under standard conditions is practically zero.

The removal of the SO_2Cl_2 may be accomplished either with water, or with more of the solvent spirit, or by evaporation. The treated wool may gain anything up to 25 per cent. in tensile strength and up to 37 per cent. in extensibility. The softness is slightly reduced, but this can be counteracted by the addition of a softening agent such as sapamine. The product is slightly yellow in colour, but can easily be bleached. The damage to the fibres, as measured by the alkaline solubility of the treated material, is very small, the product being practically insoluble in alkali under the conditions of the standard test, whereas chlorine-treated wool may dissolve in quantities up to 10 per cent. or more.

Microscopic examination showed that the SO_2Cl_2-treated wool preserves its epithelial scales intact, and also, the S-content is scarcely reduced, in marked contrast to the effect of chlorine. It was also established that the effect is due to the chloride as such, since removal of the latter with white spirit yielded a wool in no wise different from that obtained when the chloride was extracted with water, and also, treatment of the wool with an aqueous solution of HCl and H_2SO_4, the products of the hydrolytic decomposition of sulphuryl chloride, had no defelting action.

LETTERS TO THE EDITOR

Welding Methods

SIR,—A recent editorial in THE CHEMICAL AGE raised the question of the relative merits of welding processes, with particular reference to the manufacture of chemical plant of stainless steels and non-ferrous metals. The letter published in your columns the following week in defence of oxy-acetylene welding was particularly interesting. In general your correspondent's contentions are quite correct—that both the oxy-acetylene and electric arc processes had early difficulties in preventing impurities from contaminating the deposited weld metal, but development over years has since overcome such difficulties. Also, as your correspondent concludes, welding is the only possible method of manufacture for a great deal of equipment—both from the point of view of the working characteristics of the finished product, and also from the cost standpoint.

An interesting view in support of this statement was recently published by the American oil industry, when it was stated that but for the use of welding it would be impossible to manufacture oil cracking units capable of operating at 1,000° F. at pressure of 1,000 lbs. per sq. in. If it were not for reduced production costs made possible by the use of welded equipment, petrol would cost the consumer two or three times the present price.

With regard to the manufacture of chemical plant, it was rightly pointed out that the oxy-acetylene process is at present more widely used than the other. It would appear, however, that arc welding is more likely to be employed to a greater extent than any other process for welding non-ferrous metals, and for the nickel-chrome alloys and similar metals largely used in the manufacture of chemical plant.

As your correspondent points out, the oxy-acetylene flame can be made highly reducing or highly oxidising by the welding operator, and the quality of the weld metal deposited therefore is largely dependent upon the operator. When arc welding, the quality of the deposited weld metal is dependent upon the electrode and the coating around it. This was proved recently when results were published in a number of technical papers of tests conducted by welding operators with only a few hours welding experience at the welding school attached to our main works. All weld metal test specimens showed results which average the figures required by Lloyd's and other classification societies. The most remarkable result was the uniformity of the figures obtained from ductility and tensile test pieces.

The deduction to be drawn from such an experiment is that the quality of deposited arc weld metal is not dependent upon the operator. The operator may hold too long an arc, or too short an arc; he may have his machine set to give too high a current or too low, but the weld metal deposited will be sound. The methods of shielding the arc are, of course, largely responsible for this. The coating of the electrode gives off inert and deoxidising gases which surround and shield the arc and pool of molten weld metal. The quality of core wire, and the precision with which the coating is concentrically extruded on to the core wire are also factors contributing to this result. In oxy-acetylene welding the flux is painted or sprinkled on to the weld seam, whereas in arc welding the coating of the electrode is also the fluxing agent, is extruded to precision limits, and is perfectly evenly distributed at the point of welding.

In so far as thermal disturbance is concerned, there does not appear to have been a great deal of research into the merits of the two processes, but there is generally less change in the structure of the metal along an arc welded seam, because although the actual temperature of the arc is greater than an oxy-acetylene flame, the rate of travel of the arc is very much faster and there is less spread of heat and consequently a narrower heat-disturbed area alongside the weld. This matter of the speed of welding will undoubtedly be the deciding factor as to which process is more largely used.

In any welding operation, the actual welding cost is composed of labour charges, electrode and flux costs, and power or gas costs. Labour is usually about 50 per cent. of the total cost although it is sometimes a very much larger item.

The inherent speed of arc welding, and the fact that somewhat less reliance is placed upon the welding operator, are leading to the increased use of arc welding in the manufacture of chemical plant. As your correspondent points out quite rightly, some metals are only weldable by oxy-acetylene at present, but amongst those which are commonly used in the chemical industry and which are welded every day by the arc process, may be mentioned: 18-8 and 25-12 chrome-nickel steel; aluminium and many of the aluminium alloys; copper, bronze and brass, and many of their alloys; chrome-nickel clad steels; 4-6 per cent. chrome steels; galvanised steels; chrome-molybdenum steels; and inconel.

Undoubtedly your correspondent is perfectly accurate in his statement: "During the development (of the electric arc and oxy-acetylene processes) it has become apparent that the differences inherent in the nature of both methods provide a basis on which an impartial welding engineer can fairly allocate a given job to one or the other process on technical and economic grounds."

Whether a product shall be manufactured by welding or by some other method, and if welded how it shall be designed to secure the most efficient structure, where the weld joints shall be placed and how much weld metal shall be put there—these are questions needing far more study, and of very much greater importance than whether it shall be eventually welded by arc or gas.—Yours faithfully,

Lincoln Electric Company, Limited,
R. BUTLER,
Welding Development Department.

Welwyn Garden City, November 13.

Key Men in Scientific Industries

SIR,—It is with the greatest enthusiasm that I return to the fight for proper recognition of the Cinderella of key industries, namely, Scientific Glassware, and in support of Mr. Sheldon with whom I was at one time associated—he on the sales side and I on production.

The history of this industry may be divided into four stages.—

1. War-time establishment 1914-1920.
2. Post-war development 1920-1924.
3. Closing down.
4. Limited production with reduced range.

It cannot be denied that much of the apparatus produced in Stage 1 was crude and badly finished, due to lack of experience, but very acceptable and capable of filling the needs of the user in the absence of other sources of supply. These difficulties were nevertheless fully appreciated by the manufacturers, and Stage 2 represented a determined effort to improve the product in all directions and extend the range; this with such success that by 1924 practically the whole essential range of light and heavy scientific glassware was being produced in this country, not only of the highest standard but also of superior durability, resistance and accuracy. What had happened in the meantime however? This important industry was betrayed, firstly by the less enlightened dealers (there were one or two staunch supporters), and secondly by many consumers. Both delighted in destructive criticism of the British products. Now they have had what they worked for and again there is a shortage, for which the Government is not by any means entirely to blame, but to a great extent these same dealers and critics.

Stage 3 was the inevitable consequence; production was restricted even to the extent of closing down and victory went

(Continued on facing page.)

Chemical Research in Wales

Investigation of Hydrogen Cyanide

IN a departmental report contained in the 19th annual report of the Council of the University College of Swansea, presented at the annual meeting held on November 17, Professor J. E. Coates, head of the Department of Chemistry, recorded that a special lecture on "Gallium and Germanium" had been given to the Students' Chemical Society by Professor W. Pugh, of the University of Cape Town. The study of the conductivity of electrolytes in anhydrous hydrogen cyanide had been continued by Mr. W. D. E. Thomas, Department of Scientific and Industrial Research. Mr. R. H. Davies prepared apparatus and methods for direct measurement of transport numbers of electrolytes in the same solvent. Mr. R. Richards concluded his work on density and viscosity of the system hydrogen cyanide-water, and Mr. A. B. Simpson began work on the same properties in respect of dilute solutions of electrolytes in hydrogen cyanide.

Under the direction of Dr. L. E. Hinkel further work on the constitution and properties of the tetrapolymer of hydrogen cyanide has been pursued by Mr. T. I. Watkins. Under the direction of Dr. N. H. Hartshorne, Mr. D. G. Eade has continued his studies on the rate of polymorphic transformation of single crystals of mercuric iodide, and Mr. J. E. D. James has continued the work of Mr. P. G. Elias on the linear rate of transformation of monoclinic into rhombic sulphur. The degree of M.Sc. was awarded to Mr. P. G. Elias in recognition of a thesis entitled, "1. The linear rate of transformation of monoclinic into rhombic sulphur. 2. The changes undergone by certain specimens of *o*-nitroaniline stored over phosphorus pentoxide"; and to Mr. A. H. Emanuel for a thesis entitled, "Studies of hydroaromatic compounds:—(i) The influence of the methyl group in *p*-tolyl-dihydroresorcinol. (ii) The action of chlorine on 3 : 5-dichloro-1-*p*-tolyl-Δ 2,4-cyclohexadiene."

BARIUM SULPHIDE LUMINOUS PIGMENTS

An exceptionally efficient luminous pigment, composed of barium sulphide, about to be placed on the market by Campbell Industries, is reported in *Paint Technology* (1939), *4*, 44,277).

The pigment is of barium sulphide activated with strontium, and is claimed to remain luminous for a maximum of 100 hours, after 2-5 minutes activation in sunlight, or 5-10 minutes in artificial light. A regular performance of 24 hours is guaranteed. It is resistant to heat up to 1,500° C., and so can be incorporated in baking enamels. It is not attacked by water, but the activity is destroyed by acids, and the safe *p*H. is 6-7. It is also incompatible with lead. As media, cellulose acetate and methyl acrylate, or rubber derivatives, or shellac varnish are recommended, the amount of pigment being 5-15 per cent. of the vehicle. The paint may be applied by brush or spray, and can be effected on any surface, but a dark one should be first painted with one coat of white flatting.

EMERGENCY ADDRESSES

THE ANGLO-CONTINENTAL GUANO WORKS, LTD., have moved to "Wansfell," Piercing Hill, Theydon Bois, Essex.

The London office of ROBERT JENKINS AND CO., LTD., Rotherham, is now "Brackley," Rowhill, Hextable, Swanley, Kent.

THE BRITISH WOOD PRESERVING ASSOCIATION, 48 Dover Street, London, W.1, have moved temporarily to Conington Hall, near Cambridge.

The Scandinavian, chemical and part accounts department of C. TENNANT, SONS AND CO., LTD., have removed to Pinner Court, Moss Lane, Pinner, Middlesex. Telephone: Pinner 5670-3; telegrams: Tennants Pinner.

New Control Orders

Use of Food Oils

By a general licence, dated November 9, the Minister of Food authorises any person until further notice to use any of the oils specified in the schedule below otherwise than for the purpose of or in the manufacture of human or animal food, and to treat any such oils in such manner as to render the same unfit or less fit for use in the manufacture of human or animal food, for the purpose of the preparation of any medicine or medicament for internal or external use. The Schedule comprises coconut oil, cotton seed oil, gingelly (sesame) oil, ground nut oil, maize oil, olive oil, palm oil and soya bean oil.

Control of Fertilisers

The Control of Fertilisers (No. 1) Order, 1939, dated November 7, made by the Minister of Supply under Regulation 55 of the Defence Regulations, 1939, fixes the maximum price of superphosphate of lime or compound fertiliser situate in the United Kingdom. The maximum price shall be the cash price ruling, during the period of four months ending on June 30, 1939, for a fertiliser of the same or a similar specification sold under the same or similar conditions of delivery and quantity, with such additions or deductions as the Minister may authorise. The maximum prices fixed by this order are cash prices. Where credit is given to the buyer a reasonable extra charge may be made for such credit if an invoice is given and that charge is separately stated thereon.

This order shall come into force on November 10, 1939, and may be cited as the Control of Fertilisers (No. 1) Order, 1939.

A direction accompanying the order states that the basis prices may be increased by the following additions: (a) superphosphate of lime:—(i) delivered during November, 1939, 9s. per ton; (ii) delivered during December, 1939, 11s. per ton; (b) compound fertilisers:—

	Per ton s. d.
(i) delivered during November, 1939	9 0
(ii) delivered during December, 1939	11 0

Delivered during	For bags (when used). Pence per ton.	Per unit of nitrogen. Pence.	Per unit of P_2O_5. Pence. Soluble.	Insoluble	Per unit of K_2O. Pence.	General addition. Pence per ton.
1939.						
November	12	Nil	6½	3	Nil	12
December ..	12	Nil	8	4	Nil	12

LETTERS TO THE EDITOR

(*Continued from previous page.*)

to the critics, whilst skilled workers were scattered and dispersed, some to be lost entirely to the industry. Stage 4 represents a long and arduous struggle. Both Mr. Sheldon and the firms with whom he is associated deserve the highest possible praise and support for their efforts.

The history of Stage 5 has yet to be written, but I sincerely hope that if anyone is to go short of the necessary apparatus it will be those who previously welcomed the foreign products with open arms and with characteristic shortsightedness. If it were not opposed to the national interest I would even wish that they and their firms in turn would have to shut down and enjoy the fruits of their endeavours.

So in conclusion I appeal to all who appreciate this need as a form of National Service to rally to Mr. Sheldon's support in whatever direction he may require to proceed. I might add that I have now no personal interest whatever in the industries which Mr. Sheldon so ably represents.—Yours faithfully,

A. V. HUSSEY, O.B.E., J.P., A.C.G.I., M.I.Chem.E., F.I.C.

Aveley, Essex.
November 14, 1939.

Fuels for Motor Transport

Producer Designed by Government Committee

A STATEMENT on alternative fuels for motor transport was made in the House of Commons last week by the Secretary for Mines (Mr. Geoffrey Lloyd). He stated that the practical application of producer gas for transport purposes involved a number of difficult technical problems but the Government had long been aware of the potential value of producer gas in an emergency and they accordingly arranged some time ago for the matter to be comprehensively investigated by a committee.

The Minister of Mines, as seen by Wallace Coop.

As a result of experience gained in road trials the committee undertook the design of a producer specially suitable for the conversion of motor vehicles in an emergency. Following satisfactory service tests of this producer, the committee had informed him (Mr. Lloyd) that the design had reached a stage when it could be considered for manufacture. As regards conversion of vehicles, the committee's practical experience had shown that in a large number of cases the best method of conversion would be to mount the equipment upon a trailer and they had accordingly also designed and tested a suitable trailer.

The committee had not claimed particular originality for their design and they acknowledged their indebtedness to experience gained in operating existing commercial types of producer. Mention should also be made of the valuable research work being done in this field, though on somewhat different lines from that of the committee, by the British Coal Utilisation Research Association, with whom the Mines Department were in touch. The committee's design was based on the application of well-known principles to the particular problem they had before them, namely, the conversion under war conditions to producers of existing motor vehicles using fuels available in this country.

The problem of the availability of suitable fuels had been studied by the Fuel Research Station and its Coal Survey Staff, and a range of low volatile anthracite and certain types of low temperature coke had already been specified as suitable. Research on carbonisation was in progress and, if this was successful, it should be possible to widen considerably the range of fuels. Meanwhile it was most essential that producer gas operators should avoid unsuitable fuels. The advice of the Fuel Research Station would always be available on this question and the Mines Department would be ready to assist on general problems. It was important that the interests concerned should bear in mind the necessity for co-ordinating general development with the organisation of fuel supplies.

Activated Charcoal

Factors Influencing the Adsorption of Vapour

A PAPER on "Activated Charcoal" was presented by Dr. L. J. Burrage, F.I.C., A.M.I.Chem.E., F.Inst.F., a member of the research staff of Imperial Chemical Industries (General Chemicals), Ltd., Central Laboratory, Widnes, and hon. secretary of the Liverpool section of the Society of Chemical Industry, before a joint meeting of the Liverpool sections of the Institute of Chemistry, British Association of Chemists and the Society of Chemical Industry, on November 9.

Dr. Burrage explained that since the work on adsorption of vapours by activated charcoal had grown to such a vast extent since the last war, he proposed to deal with one or two aspects of the subject and would confine his remarks to details of the possible mechanism of the activation of charcoal and some factors influencing the adsorption of vapours by charcoal.

Mention was made of the more common activation agents such as air, steam, zinc chloride, etc., and their action on soft wood, nut-shell and peat. The mechanism of activation suggested that in all forms of activation it is the cellulose or the charcoal formed from the cellulose which is pitted, giving rise to areas of high adsorptive potential, whereas lignin or the charcoal formed from lignin is practically untouched. Curves were shown, which demonstrated the effect of increased activation on the isothermals of CCl_4 as deduced from the hypothesis, and experimental data were quoted which bore this out.

The author then dealt with the poisoning effect of the surface carbon-oxygen complex which could not be completely removed by evacuation. "Flushing out" with vapour was shown to remove a large amount of combined oxygen but it was not claimed that the surface even then was oxygen-free. The interesting point was that following this treatment the adsorption of vapours was now instantaneous and the resultant isothermals were shown to consist of a very large number of rectangular steps, provided that sufficient experimental points were obtained.

Dr. Burrage dealt with the adsorption of vapour by unactivated charcoal and showed that very marked differences existed, some vapours being readily adsorbed and some scarcely adsorbed at all. This was particularly the case when consideration was given to the quantities of the various substances which were adsorbed in a quasi-chemical manner.

Finally, to summarise, the mechanism of adsorption by unactivated charcoal was very complex and could be classed under a number of headings:—

1. At high pressures adsorption takes place according to the magnitude of the dielectric constant.
2. The higher the vapour pressure of the substance concerned the more effective will be the removal of the surface complex, which may either increase or decrease the amount adsorbed.
3. Certain definite amounts of adsorbed vapour are quasi-chemically held, the amount being dependent on certain atoms and their position in the molecule.
4. Some substances can combine with the complex itself and only remove the C_xO_y very slowly.

A vote of thanks to Dr. Burrage was proposed by Dr. W. H. Brindley (Manchester) and seconded by Mr. G. C. Corbett (B.A.C., Liverpool).

PERSONAL NOTES

PROFESSOR SIR ROBERT ROBINSON and PROFESSOR NIELS BOHR have had honorary B.Sc. degrees conferred on them by London University.

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AFTER six years' service as secretary of the Liverpool section of the Society of Chemical Industry, MR. JOHN S. TOWERS, of J. W. Towers and Co., Ltd., Widnes, has resigned. His successor is Dr. L. J. BURRAGE, F.I.C., A.M.I.Chem.E., F.Inst.F., a member of the research staff of Imperial Chemical Industries (General Chemicals), Ltd.

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MR. A. MULLINS, C.M.G., C.B.E., Deputy Comptroller-General of the Department of Overseas Trade, who, since the outbreak of hostilities, has held the appointment of Principal Officer to the Midland Region (Civil Defence), has now been recalled and appointed Acting Comptroller-General of the Department of Overseas Trade.

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DR. H. COLIJN, until recently the Prime Minister of the Netherlands, DR. K. P VAN DER MANDELE, president of the Rotterdam Bank, and DR. TH. A. FRUIN, the Rotterdam jurist, are joining the board of Lever Brothers and Unilever N.V. as advisory directors. MR. ARTHUR HARTOG, who is in charge of the Unilever interests in France, has resigned from the board of Lever Brothers and Unilever N.V. and is joining the board of Lever Brothers and Unilever, Ltd.

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MR. ARTHUR RUSSELL has been elected president of the Mineralogical Society for 1940. The vice-presidents are Professor C. E. Tilley and Dr. W. Campbell Smith; the treasurer, Mr. F. N. Ashcroft; the general secretary, Dr. G. F. Claringbull; the foreign secretary, Sir Thomas H. Holland; editor of the Journal, Dr. L. J. Spencer; ordinary members of Council, Dr. G. F. Herbert Smith, Dr. F. C. Phillips, Sir Lewis L. Fermor, Professor H. L. Bowman, Dr. H. F. Harwood, Mr. G. E. Howling, Dr. W. F. P. McLintock, Dr. J. Premister, Professor H. Simpson, Mr. F. A. Bannister, Mr. S. I. Tomkeieff and Dr. S. R. Nockolds.

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MR. B. D. W. LUFF, F.I.C., Chairman of the Liverpool section of the Society of Chemical Industry, at the joint meeting of the Society of Chemical Industry, Institute of Chemistry and British Association of Chemists, held at Liverpool, on Thursday, November 9, distributed the following prizes to young chemists: Leverhulme Chemistry Prize, founded by the late Lord Leverhulme, and awarded, on the recommendation of the University of Liverpool, to MR. GERARD GROWNEY. Recommended by the Liverpool Technical College: Special Merit Prize, to MR. S. P. HAYES (who is to join the staff of Lever Bros.); Senior Prize to MR. A. A. MCKERRIGAN; Junior Prize to MR. JAMES SIMPSON.

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SIR ANDREW AGNEW, managing director of the Shell Transport and Trading Co., MR. R. BEAUMONT, deputy chairman and managing director of Trinidad Leaseholds, SIR WILLIAM FRASER, deputy chairman of the Anglo-Iranian Oil Co., and subsidiary companies, MR. F. GODBER, vice-president of the Canadian Eagle Oil Co., MR. F. L. HALFORD, director and general manager of Shell-Mex and B.P., Ltd., MR. A. HITTINGER, managing director of the National Benzole Co., MR. A. J. SINGLETON, managing director of the Texas Co. (of Ireland), MR. E. E. SOUBRY, director of Stemco and Associated Ethyl Co., and MR. F. J. WOLFE, chairman and managing director of the Anglo-American Oil Co., and chairman of the British-Mexican Petroleum Co., are members of the Petroleum Board which was recently enlarged to represent substantially the whole of the petroleum industry so far as it relates to the importation, storage and distribution of oil products.

MR. C. C. HALLETT has been elected to the board of Harold Wilson, and Witco, Ltd., colour and pigment manufacturers.

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THE new president of the Institution of Engineering Inspection is MR. H. V. SENIOR (of the Brush Electrical Engineering Co.), the well-known diesel engine authority.

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MR. JAMES NIMMO, B.A., B.Sc., has resigned his directorship of James Nimmo and Co., Ltd., and of Nimmo and Dunlop, Ltd., coalmasters, Glasgow, in order to take up an appointment with the United Steel Companies, Ltd.

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MR. JOSEPH J. CARTER, chairman of Crossley-Premier Engines, Ltd., Sandiacre, Nottingham, and managing director of Crossley Brothers, Ltd., Manchester, has been elected president of the British Engineers' Association.

OBITUARY

MR. JAMES HILL, who was for many years cashier at Bathgate Chemical Works, owned by Scottish Oils, Ltd., died recently, aged 65.

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MR. J. R. D. BARFOOT, for many years metallurgist to the Grassmoor and Sheepbridge Companies and to the Chesterfield Gas Works, has died.

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MR. RICHARD EXTON GARDNER, vice-chairman and joint managing director of Yardley and Co., Ltd., soap and perfumery manufacturers, died recently, aged 60.

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MR. THOMAS THORNLEY, a prominent figure in the Scottish chemical manufacturing industry, died at Falkirk recently. He was formerly managing director of Cross Chemical Co., Ltd., Falkirk. During the last war he served with the Ministry of Munitions and was awarded an O.B.E.

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MR. DAVID PERRY, J.P., chairman of Perry and Hope, Ltd., manufacturing chemists, Nitshill, Renfrewshire, died at his home in Glasgow recently. Mr. Perry, who was 84 years of age, was a former chairman of the Scottish Section of the Society of Chemical Industry, a member of the Merchants' House of Glasgow, a Past Deacon of the Incorporation of Bonnetmakers and Dyers, and also of the Deacons' Association.

TWENTY YEARS AGO

IN its issue of November 15, 1919, THE CHEMICAL AGE discussed the relative merits of the Haber method and the cyanamide process for ammonia synthesis. A well-known British chemist had suggested that the operations in the Haber method were of so involved a nature that technical skill of the highest order was essential to success.

THE CHEMICAL AGE, on the other hand, states: "We see no reason why difficulties which can be surmounted by the average plodding and automatic German should be too intricate to be mastered by our own chemists. The Germans we know boast that successful operation depends upon the 'special skill which they alone have acquired.' We have come up against these vainglorious pretensions before and no doubt they are to an extent a highly useful deterrent when dealing with possible rivals in industry."

General News——From Week to Week

DAMAGE estimated at about £800 was caused by an outbreak of fire last week in the premises of the British Dyewood Co., Ltd., dye manufacturers, Shettleston Road, Glasgow. The outbreak, which was located in the coopers' shed, was quickly got under control, but the lower floors of the building, which were of timber, were gutted.

PAINT WORKS employees in Scotland will receive as from last week a 2s. increase and proportionate amounts will be added to the rates of piece workers, both youths and girls, as a result of negotiations completed between the National Union of General and Municipal Workers and the paint and oil section of the Scottish Chamber of Commerce.

BEFORE THE Royal Society of Arts on Wednesday, November 15, under the presidency of Dr. E. F. Armstrong, Mr. H. Gwynn Jones read an interesting paper on the charcoal-iron industry. He dealt particularly with the attempts to discover a substitute for charcoal, mainly in the 18th Century, with special reference to the Society's MSS. The period covered was an era of eclipse in the English iron industry; the supply of charcoal was waning; timber was needed for the navy and acts against deforestation had to be passed. Enterprising ironmasters therefore sought for a substitute throughout the 17th and 18th Centuries; and endeavours were made to utilise coke for iron smelting, but coal does not appear to have come into use until about 1735-45, at Coalbrookdale. Even quite late in the century—after 1761—the documents prove that the iron industry was still tied to charcoal. Coal had not by then been found suitable to convert pig-iron into good bar-iron, not to mention steel. It was the final success in smelting iron with coal that changed the industry and localised it in regions where coal and iron ore were found side by side.

THE PRESIDENT AND CHAIRMAN of the Purchasing Officers' Association for this session are Mr. L. Dunkerley (of Rowntree & Co., Ltd.), and Major W. Lewthwaite (of the General Electric Co., Ltd.). But for the war the Association's training and examinations scheme would have been launched this autumn and the courses for the intermediate examination would have been available to students in some thirty technical and commercial colleges. Many of the latter were closed on the outbreak of war though some are now re-opening. The courses are now available to students at the following: Acton Technical College; City of Birmingham Commercial College; Derby Technical College; Dudley and Staffordshire Technical College; Leicester College of Technology; Liverpool School of Commerce; Smethwick Municipal College; Widnes Municipal Technical College; Wigan and District Mining and Technical College; Wolverhampton and South Staffordshire High School of Commerce. The following colleges are prepared to give tuition if adequate air-raid shelter accommodation can be found for the students: Leeds College of Commerce; London North-Western Polytechnic; Rugby College of Technology; Stafford County Technical College.

AMONG current scientific developments, said Mr. E. Brace Ball, president of the Institution of Mechanical Engineers, in an address which he gave last week at Glasgow Royal Technical College, that most likely to affect the life of the average man within the next 25 years was the possibility of harnessing the free energy from the sun—the greatest of all sources of power. In a month the sun lavished on the earth as much energy as ever could be obtained from all the coal beneath it. Private and industrial laboratories were organising and financing the attack on the sun as a source of power, and one institute of technology was recently endowed with £120,000 for research on the subject. Cheap abundant solar power might change the Sahara, the Sudan and other arid lands into thickly populated countries. It might come to pass that nations would scramble, not for coal and oil, but for control of the great sunlit desert places, and Libya, which Mussolini had designated a useless waste of sand, might one day be a priceless possession. Other radical changes envisaged by Mr. Ball were in methods of lighting by fluorescent lamps and materials; new fibres for clothes, such as Nylon, made from coal, air and water, and Vinyon, made from petroleum products, which was virtually unshrinkable, fireproof, water-resistant, and more elastic than silk.

THE NEXT MEETING of the Electrodepositors' Technical Society will be held at the Northampton Polytechnic, St. John Street, London, E.C.1, on Monday next at 7 p.m., when Mr. A. W. Hothersall and Dr. G. E. Gardam will present a paper on "Structure and Properties of Nickel Deposits."

ON BEHALF of its members, the National Union of Dyers, Bleachers and Textile Workers has applied to the Allied Association of Bleachers, Dyers, Printers and Finishers for advances in wages for time workers and piece workers in the bleaching, dyeing, finishing and calico printing trade. About 80,000 operatives are affected.

THE NATIONAL UNION of General and Municipal Workers has negotiated increases for members employed at the Dyce Chemical Works, Aberdeen. Mr. John McVicar, the organiser, states that the agreement provides for an advance of 4s. and payment for time lost because of air raid warnings. A similar agreement has been obtained for the employees of the Scottish Agricultural Industries Commercial Key Group, Aberdeen, and the Aberdeen Lime Company.

Foreign News

YUGOSLAVIA has resumed the export of bauxite, the principal ore from which aluminium is obtained, to Germany, according to the German official wireless, says Reuter.

ARSENIOUS ANHYDRIDE is now manufactured in Italy by the S.A. Rumianca from the arsenical pyrites found in the Val d'Ossola.

A METHOD for the synthesis of anthanthrone from 2-methyl naphthalene has been devised by Reich and Fierz at the Zurich Technical High School. 2-methyl-naphthalene is now available at a comparatively low price as a by-product of coal tar in the United States.

CRUDE ANTHRACENE is refined with the aid of maleic anhydride according to Russian Pat. 52,391. The anthracene-maleic anhydride addition product is hydrolised with alkali and the residue after acid precipitation is transformed into anthracene by heating at above 270° C.

AMONG THE PRODUCTS on view at the recently held Milan Inventions Exhibition was the high explosive made in Italy under the name of Nitrometriol. Metriol is methyl trimethyl methane and is made from glucose and methyl alcohol. Nitrometriol is reported to be superior to nitroglycerine in stability and resistance to heat and shock.

OILS, electrically treated to increase their viscosity, are now being used extensively by Germany as aeroplane lubricants, according to Dr. B. H. Lincoln of the Continental Oil Company, who recently gave a paper on the subject to the American Oil Chemists' Society, meeting in Chicago. The process was originally developed by the Belgian Elektrion Company and was later made available to the Royal Dutch Shell who improved the process. The action of the electrical discharge induces polymerisation of the oil molecules (both vegetable and animal oils are used) and increases their lubricating properties. The oils so treated are known as "voltolised" oils, and are then blended with ordinary mineral oils to produce a superior aeroplane lubricant. The KLM Dutch air liners flying to the East Indies use such electrically-treated oils for lubrication.

THE LAST TWO decades have seen most of the development of the Finnish chemical industry—a development that has followed the building up of Finnish home-market industries. The industry is primarily dependent upon imports for most of its raw material requirements. Data for all classes in the foreign trade during the current year are lacking, but imports of the principal commodities show an importation of chemicals and allied products valued at about £880,000 during the first seven months of 1939, a decline of about 12 per cent. from the corresponding period of 1938. The decline in the total value was due chiefly to rather appreciable losses in receipts of fertilisers, with the exception of ammonium sulphate, and in rosin. Imports of industrial chemicals and paint products were, for the most part, above those of the 1938 period, the outstanding exceptions being in Glauber salt and calcium carbide. Sulphur is the most important item imported, and 22,000 tons were received in the first seven months of 1939.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Applications for Patents

PRODUCTION OF LUMINESCENCE and compositions therefor.—G. C. Blakeway. 28253.

PRODUCTION OF PROTECTIVE COATINGS OR LININGS for containers, etc., for mineral oils, denatured alcohols, etc.—W. H. Boorne. 28425.

COATING COMPOSITIONS.—F. J. R. Bowman and Bakelite, Ltd. 28277.

MEANS FOR FIRING GAS PRODUCERS and for analogous purposes. Brush Electrical Engineering Co., Ltd., and H. V. Senior. 28238.

GAS PRODUCERS.—Brush Electrical Engineering Co., Ltd., and H. V. Senior. 28239.

FILTER MEDIUM.—Carbide and Carbon Chemicals Corporation. (United States, Nov. 2, '38.) 28196.

PROCESS AND PLANT for the treatment of sewage, etc., and the manufacture of fertilisers.—J. A. Coombs. 28541.

MANUFACTURE OF GLUCOSE from potatoes.—Corn Products Co., Ltd., and H. G. Wascher. 28507.

MANUFACTURE OF POTATO STARCH.—Corn Products Co., Ltd., and H. G. Wascher. 28508.

MANUFACTURE OF DYESTUFFS of the anthraquinone series.— E. I. du Pont de Nemours and Co. (United States, Oct. 21, '38.) 28339.

MANUFACTURE OF THERAPEUTICAL MATERIALS.—E. I. du Pont de Nemours and Co. (United States, Oct. 21, '38.) 28500.

PREPARATION OF MAGNESIUM COMPOUNDS from dolomite.—P. Gross. 28569.

SHAPING OF CELLULOSE ACETATE.—Hercules Powder Co. (United States, Nov. 30, '38.) 28515.

PROCESS OF FATLIQUORING SKINS.—Hercules Powder Co. (United States, Dec. 1, '38.) 28703.

PRODUCTION OF CELLULOSE.—E. B. Higgins. (France, Oct. 20, '38.) 28345.

PRODUCTION OF PLASTIC COMPOSITIONS from scrap leathers.—R. R. Howroyd and R. S. Esplen. 28638.

PRECIPITATION OF A PIGMENT from a solution of the pigment in concentrated acid.—Interchemical Corporation. (United States, Oct. 28, '38.) 28268. (United States, June 24.) 28269.

PHYSICO-CHEMICAL PROCEEDINGS for nutrients, beverages, etc.—R. Keller 28449.

CYCLAMMONIUM QUATERNARY SALTS.—Kodak, Ltd. (United States, Oct. 21, '38.) 28328.

LOW DYE RETENTION SUBSTITUTE for photographic film.—Kodak, Ltd. (United States, Oct. 21, '38.) 28329.

PROCESS AND APPARATUS for coating supports.—Kodak, Ltd. (United States, Oct. 25, '38.) 28451.

LUMINESCENT APPLIANCES.—E. E. Loening and Belcolor, Ltd. 28643.

PROCESS FOR THE PRODUCTION OF PENTAERYTHRITE.—Lonza Elektrizitätswerke und Chemische Fabriken A.-G. (Switzerland, Oct. 17, '38.) 28230.

MANUFACTURE OF AMMONIUM SULPHATE.—R. M. Roberts and Imperial Chemical Industries, Ltd. 28501.

CATALYTIC CONVERSION OF HYDROCARBONS.—Standard Oil Co. (United States, Dec. 21, '38.) 28259.

MANUFACTURE OF HYDROCARBONS boiling within the gasoline range.—Standard Oil Development Co. (United States, Dec. 7, '38.) 28512.

MANUFACTURE OF GASOLINE and like hydrocarbons.—Standard Oil Development Co. (United States, Dec. 7, '38.) 28615.

DIESEL FUELS.—Standard Oil Development Co. (United States, Nov. 30, '38.) 28701.

FILTERING APPARATUS.—Stellar Filtration and Equipment Co., Ltd., and J. G. Royce. 28360.

METHODS OF ALTERING THE VELOCITY of flow of electrons.—A. H. Stevens (Board of Trustees of the Leland Stanford Junior University). (April 21, '38.) 28659.

MANUFACTURE OF AZO PIGMENTS.—H. J. Twitchett and Imperial Chemical Industries, Ltd. 28577.

FORCE-FEED LUBRICATING APPARATUS.—Vacuum Oil Co., Ltd., and D. Whyte. 28377.

Complete Specifications Open to Public Inspection

FILLING AND EMPTYING storage containers for liquefied gas.—Soc. L'Air Liquide, Soc. Anon. Pour l'Etude et l'Exploitation des Procedes G. Claude. April 1, 1938. 20027/38.

METHOD FOR THE REGENERATION OF CATALYSTS.—Standard Oil Development Co. April 5, 1938. 6546/39.

MANUFACTURE OF CATALYSTS and the use of such catalysts in the cracking of hydrocarbons.—Standard Oil Development Co. April 5, 1938. 7154/39.

INSECTICIDAL COMPOSITIONS.—Dow Chemical Co. March 28, 1938. 7445/39.

PRODUCTION OF SULPHUR-CONTAINING CONDENSATION PRODUCTS. Silesia, Verein-Chemischer Fabriken. March 26, 1938. 7838/39.

MANUFACTURE OF A CATALYST and the treatment of hydrocarbons therewith.—Standard Oil Development Co. April 5, 1938. 7514/39.

PROCESS FOR PRODUCING BRANCHED or more branched saturated hydrocarbons from non-branched or less-branched saturated hydrocarbons respectively.—N. V. de Bataafsche Petroleum Maatschappij. April 1, 1938. 7840/39.

MANUFACTURE OF STABLE PHARMACEUTICAL PREPARATIONS.—I. G. Farbenindustrie. March 11, 1938. 7871/39.

SEPARATION OF BUTADIENE FROM HYDROCARBON MIXTURES containing same.—Dow Chemical Co. April 2, 1938. 8231/39.

UREA-ALDEHYDE CONDENSATION PRODUCTS.—Bakelite Ges. April 5, 1938. 9710/39.

METHOD OF AND APPARATUS FOR CONVERTING HYDROCARBON OILS.—M. W. Kellogg Co. April 2, 1938. 10275/39.

MANUFACTURE OF DISAZO DYESTUFFS.—Durand & Huguenin A.-G. April 4, 1938. 10329/39.

DYEING OF MIXED FABRICS.—I. G. Farbenindustrie. April 5, 1938. 10382/39.

PROCESS FOR THE PRODUCTION OF OXIDATION PRODUCTS, especially fatty acids, alcohols, or the like.—W. A. Farenholtz, G. Hubbe and H. Hubbe (trading as Vereinigte Oelfabriken Hubbe & Farenholtz). April 4, 1938. 10526/39.

Specifications Accepted with Date of Application

PRODUCTION OF HYDROCARBON MOTOR FUEL.—Process Management Co., Inc. (Jan. 6, 1937.) 513,674.

PRODUCING GASEOUS MIXTURES CONTAINING CARBON MONOXIDE AND HYDROGEN suitable for conversion into hydrocarbons.—London Testing Laboratory, Ltd., and M. Steinschlaeger. Feb. 17, 1938. 513,778.

REMOVING SUSPENDED MATTER FROM OLEAGINOUS LIQUIDS.—F. B. Dehn (Union Oil Co. of California). March 1, 1938. 513,631.

MANUFACTURE OF CALCIUM CARBIDE IN ELECTRIC FURNACES.—A.-G. fur Stickstoff-Dunger. (March 27, 1937.) 513,642.

MANUFACTURE OF SULPHURIC ACID.—Imperial Chemical Industries, Ltd. (April 2, 1937.) 513,659.

MANUFACTURE OF AMINO FATTY ACID DERIVATIVES.—J. R. Geigy A.-G. April 4, 1938. 513,663.

PRODUCTION OF CARBONYL COMPOUNDS derived from sterols and bile acids or their derivatives.—Soc. of Chemical Industry in Basle. (May 14, 1937.) 513,594.

RECOVERY OF GLYCEROL.—National Maize Products, Ltd. (Sept. 15, 1937.) 513,595.

ARTICLES COMPRISING SILICON CARBIDE.—W. J. Tennant (Carborundum Co.). April 11, 1938. 513,728.

ALLOYING MOLYBDENUM WITH FERROUS METALS.—Climax Molybdenum Co. (Jan. 18, 1938.) 513,604.

MANUFACTURE OF HYDROXY-ALDEHYDES AND HYDROXY-KETONES.—A. W. C. Taylor, J. W. Woolcock, D. Tyrer and Imperial Chemical Industries, Ltd. April 14, 1938. 513,708.

MOULDING POLYMERISED ETHYLENE.—A. Renfrew, J. W. Davison and Imperial Chemical Industries, Ltd. April 19, 1938. 513,742.

ALKALI-ALKALINE EARTH FERTILISER, AND A PROCESS OF PRODUCING SAME.—Metallges A.-G. (June 30, 1937.) 513,744.

MANUFACTURE OF MELAMINE.—A. G. Bloxam. (June 5, 1937.) 513,760.

PRODUCTION OF CYCLOPENTANOPHENANTHRENE KETONES.—N. V. Organon. (July 25, 1937.) 513,813.

MANUFACTURE OF COMPOUNDS OF *p*-TOLYLMETHYLCARBINOL.—Chemisch-Pharmazeutische A.-G. Bad Homburg, and E. Kohlstaedt. Aug. 12, 1938. 513,818.

MANUFACTURE OF COATING AND PLASTIC COMPOSITIONS.—E. I. du Pont de Nemours and Co., E. K. Ellingboe, and F. L. Salzberg. Jan. 17, 1938. 513,891.

EXTRACTION OF PROTEIN from ground nuts.—A. McLean and Imperial Chemical Industries, Ltd. Feb. 16, 1938. 513,896.

MANUFACTURE OF CEMENTS from calcium sulphate and blast-furnace slag.—J. S. Dunn, R. G. Franklin, V. Lefebure and Imperial Chemical Industries, Ltd. Feb. 22, 1938. 513,897.

MANUFACTURE OF CEMENT containing fibrous components.—V. Lefebure, J. S. Dunn, N. E. Wallace, and Imperial Chemical Industries, Ltd. Feb. 22, 1938. 513,903.

MANUFACTURE OF POLYNUCLEAR COMPOUNDS.—A. Carpmael (I. G. Farbenindustrie). March 15, 1938 513,846.

FILMS, FILAMENTS, FIBRES, or other shaped articles made by hardening proteins coagulated from their solutions.—E. C. Fieldsend, W. H. D. Boves, and Imperial Chemical Industries, Ltd. March 21, 1938. 513,910.

POLYMERISATION OF OLEFINES.—N. V. de Bataafsche Petroleum Maatschappij. March 26, 1937. 514,043.

PRODUCTION OF CELLULOSE DERIVATIVES.—E. I. du Pont de Nemours and Co. April 15, 1937. 513,917.

MANUFACTURE OF LUBRICATING OILS.—E. I. du Pont de Nemours and Co. April 17, 1937. 514,052.

Weekly Prices of British Chemical Products

QUITE a good flow of trade in industrial chemicals is reported this week and spot business in some quarters is decidedly brisk. Most of the regular items are in steady call, but it is reported that only limited supplies of acetic acid and oxalic acid are available for consumption. Deliveries against existing contracts appear to be satisfactory, calls being regular and for fair quantities. Lead oxides and white lead have been reduced by 10s. per ton, but apart from this alteration there are no important changes in quotations to record, the price position throughout most sections remaining on a steady basis. There are no items that call for particular comment in the coal tar market this week. A fair amount of business has been put through with the demand perhaps a little better than was evidenced last week. Quotations are mostly unchanged at recent levels.

MANCHESTER.—Contract deliveries of heavy chemicals on the Manchester market during the past week have been reported to be on a steady scale. So far as fresh bookings in these are concerned a generally firmer tendency of prices is in evidence. With regard to the by-products, the position of such materials as benzol and toluol is a little obscure at the moment from the point of view of prices, but in all other directions values are on a firm basis and a fair amount of buying interest has been reported.

GLASGOW.—Prices in all sections of the Scottish heavy chemical market are very firm. Considerable stocks are being built up before the year ends. Certain paint trade materials are scarce and substitutes are in demand. Owing to restrictions export business is greatly reduced.

Price Changes

Rises: Copper Sulphate (Manchester), India-Rubber Substitutes, Naphthalene, refined (Manchester), Pitch (Manchester), Sodium Hyposulphite (Manchester), Tartaric Acid (Manchester).

Falls: Carbon Disulphide, Lead, Red and White, Sodium Sulphide, concentrated solid (Manchester).

*In the case of certain products, here marked with an asterisk, the market is nominal, and the last ascertainable prices have been included.

†Coal Tar Products: The position with regard to prices of benzol and toluol is still fluid, owing to possibilities of control.

General Chemicals

ACETIC ACID.—Maximum prices per ton: 40% technical, 1 ton or over, £15 12s.; 10 cwt. and less than 1 ton, £16 12s.; 4 cwt. and less than 10 cwt., £17 12s.; 80% technical, 1 ton, £29 5s.; 10 cwt./1 ton, £30 5s.; 4/10 cwt., £31 5s.; 80% pure, 1 ton, £31 5s.; 10 cwt./1 ton, £32 5s.; 4/10 cwt., £33 5s.; commercial glacial, 1 ton, £37; 10 cwt./1 ton £38; 4/10 cwt., £29; delivered buyers' premises in returnable barrels.

ACETONE.—Maximum prices per ton, 50 tons and over, £39; 10/50 tons, £39 10s.; 5/10 tons, £40; 1/5 tons, £40 10s.; single drums, £41 10s., delivered buyers' premises in returnable drums or other containers having a capacity of not less than 45 gallons each; delivered in containers of less than 45 gallons but not less than 10 gallons £10 10s. per ton in excess of maximum prices; delivered in containers less than 10 gallons each £10 10s. per ton in excess of maximum prices, plus a reasonable allowance.

*ALUM.—Loose lump, £8 7s. 6d. per ton d/d.

*ALUMINIUM SULPHATE.—£7 5s. 0d. per ton d/d Lancs.

AMMONIA, ANHYDROUS.—99.95%, 1s. to 2s. per lb. according to quantity in loaned cylinders, carriage paid; less for important contracts.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks.

AMMONIUM CHLORIDE.—Grey galvanising £21 per ton, in casks, ex wharf. See also Salammoniac.

AMMONIUM DICHROMATE.—1s. per lb. d/d U.K.

*ANTIMONY OXIDE.—£68 per ton.

ARSENIC.—Prices nominal, f.o.b. Antwerp, subject to works acceptance.

BARIUM CHLORIDE.—Market nominal.

BLEACHING POWDER.—Spot, 35/37% £9 5s. per ton in casks, special terms for contract.

BORAX COMMERCIAL.—Granulated, £18 per ton; crystal, £19; powdered, £19 10s.; extra finely powdered, £20 10s.; B.P. crystals, £27; powdered, £27 10s.; extra fine, £28 10s. per ton, in free 1-cwt. bags, carriage paid in Great Britain. Borax Glass, lump, £60; powder, £61; in tin-lined cases for home trade only, packages free, carriage paid in Great Britain.

BORIC ACID.—Commercial granulated, £32 per ton; crystal, £33; powdered, £34; extra finely powdered, £36; large flakes, £44 10s.; B.P. crystals, £41; powdered, £42; extra fine powdered, £44 per ton for ton lots, in free 1-cwt. bags, carriage paid in Great Britain.

CALCIUM BISULPHITE.—£7 5s. per ton f.o.r. London.

*CALCIUM CHLORIDE.—GLASGOW: 70/75% solid, £5 12s. 6d. per ton ex store.

CHARCOAL LUMP.—£7 5s. to £11 per ton, ex wharf. Granulated £7 to £9 per ton according to grade and locality.

*CHLORINE, LIQUID.—£18 15s. per ton, seller's tank wagons, carriage paid to buyer's sidings; £19 5s. per ton, d/d in 16/17 cwt. drums (3-drum lots); £19 10s. per ton d/d in 10-cwt. drums (4-drum lots); 4½d. per lb. d/d station in single 70-lb. cylinders.

*CHROMETAN.—Crystals, 3d. per lb.; liquor, £13 per ton d/d station in drums.

CHROMIC ACID.—10¾d. per lb., less 2½%: d/d U.K.

*CHROMIC OXIDE.—11¾d. per lb.; d/d U.K.

CITRIC ACID.— 1s. 1d. per lb. MANCHESTER: 1s. 1¼d..

COPPER SULPHATE.—MANCHESTER: £25 per ton f.o.b.

CREAM OF TARTAR.—100%, £5 2s. to £5 7s. per cwt., less 2½%.

FORMALDEHYDE.—40% by volume, £25 to £27 per ton, according to quantity, in casks, ex store.

FORMIC ACID.—85%, £42 per ton for ton lots, ex store, in cylinders; smaller parcels quoted at 45s. 6d. to 47s. 6d. per cwt., ex store.

GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £3 10s. to £4 10s. per cwt. according to quantity; in drums, £3 2s. 6d. to £3 16s. 0d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

HEXAMINE.—Technical grade for commercial purposes, 1s. 4d. per lb.; free-running crystals are quoted at 1s. 7d. per lb.; carriage paid for bulk lots.

HYDROCHLORIC ACID.—Spot, 5s. 6d. to 8s. carboy d/d according to purity, strength and locality.

IODINE.—Resublimed B.P., 11s. 2d. per lb. in 7 lb. lots.

*LACTIC ACID.—(Not less than ton lots). Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50%, by vol., £41. One ton lots ex works, barrels free.

LEAD ACETATE.—LONDON: White, £48 to £50, ton lots. MANCHESTER: Market nominal. GLASGOW: Market nominal.

LEAD NITRATE.—About £40 per ton in casks.

LEAD, RED.—English, 5/10 cwt., £34 10s.; 10 cwt. to 1 ton, £34 5s.; 1/2 tons, £34; 2/5 tons, £33 10s.; 5/20 tons, £33; 20/100 tons, £32 10s.; over 100 tons, £32 per ton, less 2½ per cent. carriage paid; non-setting red lead, 10s. per ton dearer in each case; Continental material, £1 per ton cheaper.

LEAD, WHITE.—Dry English, less than 5 tons, £44 10s.; 5/15 tons, £40 10s.; 15/25 tons, £40; 25/50 tons, £39 10s.; 50/200 tons, £39 per ton, less 5% carriage paid; Continental material, £1 per ton cheaper. Ground in oil, English, 1/5 cwt., £52 10s.; 5/10 cwt., £51 10s.; 10 cwt. to 1 ton, £51; 1/2 tons, £49 10s.; 2/5 tons, £48 10s.; 5/10 tons, £46 10s.; 10/15 tons, £45 10s.; 15/25 tons, £45; 25/50 tons, £44 10s.; 50/100 tons, £44 per ton, less 5% carriage paid. Continental material £2 per ton cheaper.

LITHARGE.—10 cwt.-1 ton, £34 15s. per ton.

MAGNESITE.—Calcined, in bags, ex works, about £9 to £10 per ton.

MAGNESIUM CHLORIDE.—Solid (ex wharf), £10 per ton.

*MAGNESIUM SULPHATE.—Commercial, £5 10s. per ton, ex wharf.

MERCURY PRODUCTS.—Controlled prices for 1 cwt. quantities: Bichloride powder, 6s. 4d.; bichloride (industrial users), 6s. 4d.; bichloride lump, 6s. 11d.; bichloride ammon. powder, 7s. 10d.; bichloride ammon. lump, 7s. 8d.; mercurous chloride, 7s. 8d. mercury oxide, red cryst., B.P., 9s.; red levig. B.P., 8s. 6d.; yellow levig. B.P., 8s. 4d.

*METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities.

*NITRIC ACID.—Spot, £25 to £30 per ton, according to strength, quantity and destination.

OXALIC ACID.—£48 5s. per ton for ton lots, ex wharf, in casks, smaller parcels, 53s. to 57s. per cwt., ex store; deliveries slow.

*PARAFFIN WAX.—GLASGOW: 3¾d. per lb.

*POTASH, CAUSTIC.—Market nominal.

POTASSIUM CHLORATE.—Imported powder and crystals, ex store London, 10d. to 1s. per lb.

*POTASSIUM DICHROMATE.—5¼d. per lb. carriage paid. GLASGOW: 5¼d. per lb., net, carriage paid.

POTASSIUM CHROMATE.—2s. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 9s. 10¼d. per lb. in 7 lb. lots; for not less than 1 cwt., 7s. 9d. per lb.

POTASSIUM NITRATE.—Small granular crystals, £26 to £29 per ton ex store, according to quantity.

POTASSIUM PERMANGANATE.—Commercial, about 10¾d. per lb., delivered.

POTASSIUM PRUSSIATE.—Yellow, market nominal, supplies scarce.

SALAMMONIAC.—Dog-tooth crystals, £40 per ton; medium, £39; fine white crystals, £20; in casks, ex store.

SALT CAKE.—Unground, spot, £3 15s. per ton.
SODA ASH.—Light 98/100%, £5 17s. 6d. per ton f.o.r. in bags.
SODA, CAUSTIC.—Solid, 76/77° spot, £13 10s. per ton d/d station.
SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
SODIUM ACETATE.—£25 to £26 per ton, ex wharf.
SODIUM BICARBONATE.—About £10 10s. per ton, in bags.
SODIUM BISULPHITE POWDER.—60/62%, £12 10s. to £14 per ton d/d in 2-ton lots for home trade.
SODIUM CARBONATE MONOHYDRATE.—£20 per ton d/d in minimum ton lots in 2 cwt. free bags.
SODIUM CHLORATE.—£27 10s. to £32 per ton, d/d according to quantity.
*SODIUM DICHROMATE.—Crystals cake and powder 4¼d. per lb net d/d U.K. with rebates for contracts. GLASGOW: 4¼d. per lb., carriage paid.
*SODIUM CHROMATE.—5d. per lb. d/d U.K.
SODIUM HYPOSULPHITE.—Pea crystals, £15 15s. per ton for 2-ton lots; commercial, £11 15s. per ton. MANCHESTER: Commercial, £11 10s.; photographic, £16.
*SODIUM METASILICATE.—£14 5s. per ton, d/d U.K. in cwt. bags.
SODIUM NITRATE.—Refined, £8 5s. per ton for 6-ton lots d/d.
SODIUM NITRITE.—£18 5s. per ton for ton lots.
SODIUM PERBORATE.—10%, £4 per cwt. d/d in 1-cwt. drums.
SODIUM PHOSPHATE.—Di-sodium, £16 to £17 per ton delivered for ton lots. Tri-sodium, £18 10s. per ton delivered per ton lots.
SODIUM PRUSSIATE.—4¼d. to 5¼d. per lb.
SODIUM SILICATE.—£8 2s. 6d. per ton.
*SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.
*SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 to £3 10s. per ton d/d station in bulk. MANCHESTER: £3 15s.
SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 15s. per ton d/d in drums; crystals, 30/32%, £9 per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £13; commercial, £9 10s.
*SODIUM SULPHITE.—Pea crystals, spot, £14 10s. per ton d/d station in kegs.
*SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.
SULPHURIC ACID.—168° Tw., £4 11s. to £5 1s. per ton; 140° Tw., arsenic-free, £3 to £3 10s.; 140° Tw., arsenious, £2 10s.
TARTARIC ACID.—1s. 2d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 3¼d. per lb.
ZINC OXIDE.—Maximum prices: White seal, £23 10s. per ton; red seal, £21 d/d; green seal, £22 10s. d/d buyers' premises.
*ZINC SULPHATE.—Tech., £11 10s. f.o.r., in 2-cwt. bags.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 9d. to 1s. 5d. per lb., according to quality. Crimson, 1s. 7½d. to 1s. 9½d. per lb.
ARSENIC SULPHIDE.—Yellow, 1s. 6d. to 1s. 8d. per lb.
CARBON DISULPHIDE.—£25 to £30 per ton, according to quantity, in free returnable drums.
CARBON TETRACHLORIDE.—£48 to £53 per ton, according to quantity, drums extra.
CHROMIUM OXIDE.—Green, 1s. 3d. per lb.
INDIA-RUBBER SUBSTITUTES.—White, 5¾d. to 6¾d. per lb.; dark 5½d. to 6d. per lb.
LITHOPONE.—30%, £16 15s. per ton.
SULPHUR CHLORIDE.—6d. to 8d. per lb., according to quantity.
VEGETABLE BLACK.—£35 per ton upwards; 28/30%, £15 10s. 0d.; 60%, £29, delivered buyers' premises.
ZINC SULPHIDE.—£56 per ton ex works.

Plus 5% War Charge.

Nitrogen Fertilisers

AMMONIUM SULPHATE.—The following prices have been announced for neutral quality basis 20.6% nitrogen, in 6-ton lots delivered farmer's nearest station up to June 30, 1940: September, £7 5s.; October, £7 6s. 6d.; November, £7 8s.; December, £7 9s. 6d.; January, 1940; £7 11s., February £7 12s. 6d.; March/June, £7 14s.
CALCIUM CYANAMIDE.—The following prices are for delivery in 5-ton lots, carriage paid to any railway station in Great Britain up to June 30, 1940; September £8 2s. 6d.; October £8 3s. 9d.; November £8 5s.; December, £8 6s. 3d.; January, 1940, £8 7s. 6d.; February £8 8s. 9d.; March £8 10s.; April/June, £8 11s. 3d.
NITRO-CHALK.—£7 10s. 6d. per ton up to June 30, 1940.
SODIUM NITRATE.—£8 5s. per ton for delivery up to June 30, 1940.
CONCENTRATED COMPLETE FERTILISERS.—£11 4s. to £11 13s. per ton in 6-ton lots to farmer's nearest station.
AMMONIUM PHOSPHATE FERTILISERS.—£10 19s. 6d. to £14 16s. 6d. per ton in 6-ton lots to farmer's nearest station.

Coal Tar Products

†BENZOL.—At works, crude, about 1s. 0¾d. per gal.; 90's, 1s. 9d. to 1s. 11d.; pure, 1s. 10d. to 2s. MANCHESTER: Crude, 1s. 0½d. to 1s. 1d. per gal.; pure, 1s. 10½d. per gal.
CARBOLIC ACID.—Crystals, 9d. per lb.; Crude, 60's, 3s. to 3s. 3d. according to specification. MANCHESTER: Crystals, 8¼d. to 9d. per lb., d/d; crude, 2s. 9d. to 3s. naked, at works.
CREOSOTE.—Home trade, from 4½d. per gal., f.o.r., makers' works; exports 6d. to 6¼d. per gal., according to grade. MANCHESTER: 4d. to 5¾d.
CRESYLIC ACID.—98/100%, 2s. 6d. to 2s. 9d. per gal., according to specification. MANCHESTER: Pale, 99/100%, 2s. 10d.
NAPHTHA.—Solvent, 90/160°, 1s. 9d. to 2s. per gal.; solvent, 95/160°, 2s. to 2s. 3d., naked at works; heavy 90/190°, 1s. 6d. per gal., naked at works, according to quantity. MANCHESTER: 90/160°, 1s. 6d. to 1s. 8d. pre gal.
NAPHTHALENE.—Crude, whizzed or hot pressed, £7 to £7 10s. per ton; purified crystals, £9 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £3 to £4 10s. per ton. MANCHESTER: Refined, £18.
PITCH.—Medium, soft, 36s. per ton, f.o.b. MANCHESTER: 35s. f.o.b. East Coast.
PYRIDINE.—90/140°, 17s. 6d. per gal.; 90/160°, 15s.; 90/180°, 3s. to 4s. per gal. f.o.b. MANCHESTER: 14s. to 17s. 6d. per gallon.
†TOLUOL.—90%, 2s. 4d. to 2s. 6d. per gal.; pure, 2s. 6d. to 2s. 7d. MANCHESTER: Pure, 2s. 7d. per gallon, naked.
XYLOL.—Commercial, 2s. 3d. to 2s. 6d. per gal.; pure, 2s. 9d. to 3s. MANCHESTER: 2s. 6d. per gal.

Wood Distillation Products

CALCIUM ACETATE.—Brown, £7 5s. to £8 per ton; grey, £9 to £11. MANCHESTER: Grey, £14.
METHYL ACETONE.—40.50%, £35 to £38 per ton.
WOOD CREOSOTE.—Unrefined, 8d. to 1s. per gal., according to boiling range.
WOOD NAPHTHA, MISCIBLE.—3s. 3d. to 3s. 8d. per gal.; solvent, 3s. 4d. to 3s. 9d. per gal.
WOOD TAR.—£3 to £8 per ton, according to quality.

Intermediates and Dyes

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.
ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.
BENZALDEHYDE.—1s. 10d. per lb., for cwt. lots, net packages.
BENZIDINE, HCl.—2s. 7d. per lb., 100% as base, in casks.
BENZOIC ACID, 1914 B.P. (ex toluol).—1s. 11d. per lb. d/d buyer's works.
m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.
p-CRESOL 34/35° C.— 1s. 7d. to 1s. 8d. per lb. in ton lots.
DICHLORANILINE.—2s. 1½d. to 2s 5½d. per lb.
DIMETHYLANILINE.—Spot, 1s. 7½d. per lb., package extra.
DINITROBENZENE.—7½d. per lb.
DINITROCHLORBENZENE, SOLID.—£79 5s. per ton.
DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 11d.
DIPHENYLAMINE.—Spot, 2s. 3d. per lb.; d/d buyer's works.
GAMMA ACID, Spot, 4s. 4½d. per lb. 100%, d/d buyer's works.
H ACID.—Spot, 2s. 7d. per lb.; 100%, d/d buyer's works.
NAPHTHIONIC ACID.—1s. 10d. per lb.
β-NAPHTHOL.—£97 per ton; flake, £94 8s. per ton.
α-NAPHTHYLAMINE.—Lumps, 1s. 1d. per lb.
β-NAPHTHYLAMINE.—Spot, 3s. per lb.; d/d buyer's works.
NEVILLE AND WINTHER'S ACID.—Spot, 3s. 3½d. per lb. 100%.
o-NITRANILINE.—4s. 3½d. per lb.
m-NITRANILINE.—Spot, 2s. 10d. per lb. d/d buyer's works.
p-NITRANILINE.—Spot, 1s. 10d. to 1s. 11d. per lb. d/d buyer's works.
NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra, 1-ton lots d/d buyer's works.
NITRONAPHTHALENE.—9½d. per lb.; P.G., 1s. 0½d. per lb.
SODIUM NAPHTHIONATE.—Spot, 1s. 11d. per lb.; 100% d/d buyer's works.
SULPHANILIC ACID.—Spot, 8¾d. per lb. 100%, d/d buyer's works.
o-TOLUIDINE.—10½d. per lb., in 8/10 cwt. drums, drums extra.
p-TOLUIDINE.—1s. 10½d. per lb., in casks.
m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Latest Oil Prices

LONDON, Nov. 15.—To November 25 (per ton, net, naked, ex mill, works, or refinery, and subject to additions according to package):—LINSEED OIL, raw, £36. RAPESEED OIL, crude, £26; washed, £28 15s.; refined edible, £29 12s. 6d.; refined deodorised, £30 10s. SOYA BEAN OIL, crude, £27; refined deodorised, £31. GROUNDNUT OIL, crude, £29 10s.; refined deodorised, £34. COCONUT OIL, crude, £22 2s. 6d.; refined deodorised, £25 7s. 6d. PALM OIL, refined deodorised, £27. PALM KERNEL OIL, crude, £21 10s.; refined deodorised, £24 15s. WHALE OIL, crude hardened, 42 deg., £24 10s.; refined hardened, 42 deg., £27. ACID OILS.—Groundnut, £16; soya bean, £15; coconut and palm kernel, £18 10s. There was very little interest in non-controlled commodities and prices were generally unaltered. ROSIN, 25s. to 30s. per cwt., according to grade. TURPENTINE, 62s. 6d. per cwt., spot, American, including tax, ex wharf, barrels and ex discount.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

COUPE AND TIDMAN, LTD., Pontypridd, manufacturers of refractories. (M. 11/11/39.) October 26, £500 debenture to Special Areas Reconstruction Association, Ltd.; general charge. *£3,000. June 15, 1939.

DALO LTD., London, S.W., paint manufacturers. (M., 11/11/39). October 25, £1,000 (not ex.) deb., to R. J. Pritchard, London, and another; general charge.

MILFORD PRODUCTS CO., LTD. (Derby), manufacturing chemists. (M. 11/11/39.) October 30, £300 (not ex.) debentures, present issue £100; general charge. *Nil. December 31, 1938.

LANDORE CHEMICAL CO., LTD. (M., 18/11/39.) Nov. 2, debenture to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge.

LONABARC COLOUR WORKS, LTD., London, S.E. (M., 18/11/39.) Nov. 6, £750 debentures; general charge. *£2,000 debentures, May 20, 1939.

Satisfactions

ERNEST J. COLE AND PARTNERS, LTD., Bristol, oil, etc., dealers. (M.S. 11/11/39.) Satisfaction November 1. £1,100, registered June 2, 1939.

B. C. TIPPER AND SON, LTD., Birmingham, manufacturers and dealers in animal medicines. (M.S., 18/11/39.) Satisfaction Nov. 8, of debentures registered Oct. 27, 1925, to extent of £4,000.

WILLESDEN VARNISH CO., LTD. (M.S., 18/11/39.) Satisfaction Nov. 7, £7,000, registered April 8, 1926.

Declarations of Solvency Filed

EXETER CONDENSED GAS CO., LTD., London, S.W. (D.S.Y. 11/11/39.) November 1.

WOOD FINISHES (LIVERPOOL), LTD., oil and colourmen. (D.S.Y. 11/11/39.) October 26.

Companies Winding-Up Voluntarily

BRITISH AERO LUBRICANTS, LTD. (C.W.U.V. 11/11/39.) October 19. G. W. Bacon, Norfolk House, Laurence Pountney Hill, E.C., liquidator.

Company News

Borax Consolidated, Ltd., announce a half-yearly payment of three per cent. (same) on the six per cent. preferred shares.

Fison, Packard and Prentice, Ltd., have declared a final ordinary dividend of 7½ per cent., making 10 per cent., less tax, for the year to June 30 last (same).

Lewis Berger and Sons, Ltd., announce a final dividend of 7 per cent. which, with the interim already paid, makes a total of 13 per cent. for the year (15 per cent.).

Lever Brothers and Unilever, Ltd., have declared an interim dividend of 4¾ per cent. on their ordinary capital (4 per cent.). Lever Brothers and Unilever N.V. are maintaining their interim dividend at 3 per cent.

British Industrial Plastics, Ltd., report net profits for the year ended September 30 of £22,404 (£22,185) after providing for abnormal legal and A.R.P. expenses out of revenue. Application has been made, however, for Government grants covering a large proportion of the A.R.P. expenditure. The dividend is two per cent. higher at eight per cent.

New Companies Registered

Auralite Luminous Products, Ltd. (357,358).—Private company. Capital, £3,500 in 14,000 shares of 5s. each. To carry on business as manufacturer of and dealers in paints, powders, inks, chemicals, plastic materials and products, etc. Life directors: George Becker, Berrycroft, West Humble, Dorking; Arthur E. Illingworth, Jardine Whyte, Rowland Cash, Denis Becker, George D. Clapperton and Gaston Proot. Secretary: A. Carter. Solicitors: H. B. Nisbet & Co., 47 Mecklenburgh Square, W.C.1.

Vinyl Products, Ltd. (357,538).—Private company. Capital £2,100 in 2,000 7 per cent. cumulative preference shares of £1 and 1,000 "A" ordinary and 1,000 "B" ordinary shares of 1s. To acquire and develop processes and letters patent, and to carry on the business of manufacturers of and wholesale and retail dealers in chemicals, varnishes, lacquers, paints, enamels, etc. Directors: David H. Evans and John E. O. Mayne. Solicitor: Aubrey Boutwood, 13 High Street, Leighton Buzzard. Registered office: 231 High Street, Brentford, Middlesex.

Chemical Trade Inquiries

South Africa.—H.M Trade Commissioner at Johannesburg reports that the Union Tender and Supplies Board is calling for tenders (Contract No. S.O. 484) for the supply and delivery of laboratory glassware.

Tenders should be addressed to the Secretary, Union Tender and Supplies Board, 271 Visagie Street, P.O. Box 371, Pretoria, by whom they will be received up to 9 a.m. on December 7, 1939. (Ref. T. 28773/39.)

Chemical and Allied Stocks and Shares

SENTIMENT on the Stock Exchange has been influenced by a tendency to await the outcome of the latest turn of events in international affairs. There was very little selling, but as markets were less active, moderately lower prices have ruled for industrial securities, although there was again a disposition for good class debentures and preference shares to improve on the assumption that the upward trend in gilt-edged stocks is likely to be resumed shortly.

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Imperial Chemical ordinary showed a small decline from 30s. 10½d. to 30s. 7½d., but the preference units at 31s. more than held their recent rise. Fison Packard at 37s. 6d. were slightly higher on the preliminary figures for the past year's working and the assumption that the statements at the forthcoming meeting may indicate that prospects are satisfactory. United Molasses were 6d. down at 24s. 6d. awaiting the dividend announcement. Cellon were better at around 15s. xd. aided by satisfaction with the higher interim dividend. Maintenance of the British Plaster Board interim has also created a good impression, and the shares have been fairly steady around 24s. 9d. xd. Turner and Newall had a firmer appearance at 71s. 3d., while Cerebos at £8¼ and Reckitt and Sons' ordinary at 93s. were higher on balance for the week.

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Lever and Unilever show a decline from 33s. to 30s. 6d. xd., the influence of the higher interim dividend having been more than offset by a tendency to await political developments in Holland. British Oil and Cake Mills preferred ordinary units were 37s. 6d. compared with 36s. 3d. a week ago, and Borax Consolidated were a steady feature at 25s 9d. Sanitas Trust 10s. ordinary held their recent improvement to 15s., but the price did not appear to be tested by business this week. Pinchin Johnson went back from 22s. to 20s. 6d., but the majority of other shares of paint manufacturers were steady, and Wall Paper deferred remained around 18s. 9d., on the past year's results. Imperial Smelting were slightly lower at 11s. The market is hopeful that, not only will the last-named company be able to bring the dividend on its preference shares up to date next year, but that it may also be possible to resume dividends on the ordinary shares with a small payment.

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Among iron, steel and kindred securities Dorman Long were higher, and Guest Keen were influenced by the maintained interim payment, although best prices touched during the past few days were not held. United Steel were slightly lower at 22s. Babcock and Wilcox were a steady feature at 40s. There was some buying of textile shares on the increasing activity reported in the industry, but movements in prices were relatively small. Some market men are hopeful that the forthcoming British Celanese results may announce a further payment in respect of the arrears of dividend on the first preference shares.

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Boot Drug at 41s. 6d. showed a reactionary tendency. Sangers were 20s. 6d. awaiting the interim dividend announcement, while Timothy Whites and Taylors transferred around 21s. 6d. British Drug Houses were again 21s. 3d. Following the further increase in the price of petrol, leading oil shares were steadier, but on balance movements have been to slightly lower levels. Anglo-Iranian, however, were 1s. 3d. better at 61s. 3d., and Lobitos Oilfields at 37s. 6d. were also above the price ruling a week ago.